

FULL AND COMPLETE LISTING
OF THE TEXT OF ALL CLAIMS CURRENTLY PENDING

1. (amended) Spinal osteosynthesis device comprising at least two bone-anchoring elements (1; 31) for anchoring in respective bodies (S, L5) of the bone structure of the spine, at least one member (2; 16) for longitudinally connecting the bone-anchoring elements, and shackles (3) for connecting the bone-anchoring elements together, each bone-anchoring element comprising a head (5; 33) for grasping with a screwing tool (6), a threaded shank (7) extending the head for grasping, and a tightening element (8) which can be fitted onto this shank to immobilize the assembly comprising the connector shackle, the longitudinal connecting member and the corresponding bone-anchoring element, characterized in that the threaded shank (7) has a ball end (11) for articulation in a housing (12) of a spherical cup (57) of the head (5) for grasping, allowing the shank (7) to be oriented in many directions, and allowing the connecting shackle (3) to be positioned to suit the configuration of the vertebral segment (S, L5, . . . L2) receiving the bone-anchoring element, and in that the ball (11) and [the cup (57)] an exterior surface of the head have respective centres of rotation (R1, R2) which are separated by a distance (S), giving the device, when tightened using the tightening element (8), by bearing against the [spherical cup (57)] exterior surface of the

head (5) for grasping, a function of returning the bone-anchoring element by transverse force, the connector shackle for this purpose having a spherical bearing surface (55) articulated to a portion of the spherical surface of the cup (57) of the head (5) of the bone-anchoring element.

2. Device according to claim 1, characterized in that the threaded shank (7) and the connecting shackle (3) are equipped with means for immobilizing the shank and its ball (11) in terms of rotation once the threaded shank has been introduced into a corresponding through-hole (10) through the shackle.

3. (amended) Device according to claim 2, characterized in that [the] said means for immobilizing comprises at least one rotation-stopping geometry [, preferably two, namely] comprising a first rotation-stopping geometry (13) formed on a collar (14) arranged between the ball and the contiguous end of the threaded shank (7), and a second, female, rotation-stopping geometry (15) formed on the interior edge of the hole (10) in the shackle (3), this second rotation-stopping geometry being designed to press against the first rotation-stopping geometry once the shackle has been fitted on the threaded shank.

4. (amended) Device according to claim 1, characterized in that the opposite end of the threaded shank (7) to the ball

(11) consists of a male shape (21) [, for example a half-moon shape,] designed to cooperate with a complementary female shape (23) of a tool (6) so as to immobilize the ball in terms of rotation while the tightening element (8) is being screwed onto the threaded shank (7).

5. (amended) Device according to claim 1, characterized in that the ball (11) is held in [its] the housing (12) by assembling [(for example screwing, crimping, welding, etc.)] the edge of the [latter] housing around the ball.

6. Device according to claim 1, characterized in that since the surface of the cup (57) of the head (5) is hemispherical and interrupted in the polar region to receive the ball (11), the associated spherical surface (55) of the shackle (3) at least partially covers the hemispherical surface of the cup, so as to produce either an effect of returning the bone-anchoring element (4) towards the axis, when coverage is total, as far as the equator of the cup, or a slight return, roughly maintaining the initial angular position of the bone-anchoring element, when coverage is only partial.

7. Device according to claim 6, characterized in that the connecting shackle (3) has a conical bearing surface (56) for the tightening element (8), this surface being connected to the

said spherical surface (55).

8. Device according to claim 1, characterized in that it further comprises at least one bone-anchoring element (31) comprising a threaded anchoring shank (32), a head (33) which has a transverse collar (34) and a shape (35) for grasping, for screwing, and a threaded shank (7) extending the head, the assembly being all of one piece.

9. Device according to claim 1, characterized in that the threaded shank (7) has a narrowed portion (18) delimiting two threaded regions (17) and (19) of this shank and constituting an initiator for breakage once the tightening element has been assembled and fitted on the connecting shackle, this narrowed portion therefore allowing the shank (7) to be broken.

10. Device according to claim 1, characterized in that the member for longitudinally connecting the bone-anchoring elements (1) is a vertebral rod (2) passing through the shackles (3) for connecting to the bone-anchoring elements.

11. Device according to claim 1, characterized in that the member for longitudinally connecting the bone-anchoring elements (1) and (31) is a plate (16) in which there are formed cylindrical and/or oblong openings (41, 43) delimiting possible

locations for the bone-anchoring elements and through which the threaded shanks (7) on which the immobilizing tightening elements (8) are fitted pass, and in that the openings in the plate (16) have a similar outline to that of the hole (10) in the connecting shackle (3) so as likewise to fulfil a function of returning the bone-anchoring element.

12. Device according to claim 1, characterized in that it comprises a system for transversely connecting the bone-anchoring elements (1), this system being formed of a pair of dished elements (58, 59) each of one piece with a tab (61, 62), the relative position and therefore the separation between the dished elements being adjustable for example by means of a screw-nut assembly (63, 64) passing through an elongate slot (65) in one tab (61) and a tapped hole in the second tab (62).

13. (amended) A system for installing bone anchoring element, comprising:

a spinal osteosynthesis device comprising at least two bone-anchoring elements (1; 31) for anchoring in respective bodies (S, L5) of the bone structure of the spine, at least one member (2; 16) for longitudinally connecting the bone-anchoring elements, and shackles (3) for connecting the bone-anchoring elements together, each bone-anchoring element comprising a head (5; 33) for grasping with a screwing tool (6), a threaded shank

(7) extending the head for grasping, and a tightening element (8) which can be fitted onto this shank to immobilize the assembly comprising the connector shackle, the longitudinal connecting member and the corresponding bone-anchoring element, characterized in that the threaded shank (7) has a ball end (11) for articulation in a housing (12) of a spherical cup (57) for the head (5) for grasping, allowing the shank (7) to be oriented in many directions, and allowing the connecting shackle (3) to be positioned to suit the configuration of the vertebral segment (S, L5, . . . L2) receiving the bone-anchoring element, and in that the ball (11) and [the cup (57)] an exterior surface of the head have respective centers of rotation (R1, R2) which are separated by a distance (S), giving the device, when tightened using the tightening element (8), by bearing against the [spherical cup (57)] exterior surface of the head (5) for grasping, a function of returning the bone-anchoring element by transverse force, the connector shackle for this purpose having a spherical bearing surface (55) articulated to a portion of the spherical surface of the cup (57) of the head (5) of the bone-anchoring element; and

a tool (6) for angularly positioning the threaded shank (7) and its ball (11) in the shackle (3) or the plate (16), comprising a sleeve (24) mounted to slide axially inside a socket (25), the end of which has a female shape (9) for screwing the tightening element while the end of the sleeve is provided with a

female shape (20) designed to fit over a terminal male shape (21) of the threaded shank (7) so as to immobilize the threaded shank in terms of rotation in the position corresponding to the rotation-stopping geometry while the tightening element is being fitted using a cavity (9) of the socket (25).

14. canceled

15. canceled

16. Spinal osteosynthesis device comprising:

at least two bone-anchoring elements; and

means for longitudinally connecting the at least two bone-anchoring elements;

each of the at least two bone-anchoring elements comprising:

a head shaped so as to allow grasping with a screwing tool;

a threaded shank extending from the head, and

a tightening element which can be fitted onto the threaded shank to immobilize an assembly comprising the means for longitudinally connecting and a corresponding one of said at least two bone-anchoring elements,

wherein the threaded shank has a ball end for articulation in a housing of a spherical cup of the head,

allowing the shank to be selectively oriented with respect to the head, and wherein the threaded shank and the means for longitudinally connecting are constructed and arranged so that the shank and the ball are prevented from rotating once the threaded shank has been introduced into a corresponding through-hole through the means for longitudinally connecting.

17. Device according to claim 16, wherein the threaded shank comprises a first rotation-stopping geometry arranged between the ball and an opposite end of the threaded shank, and a second, female, rotation-stopping geometry is formed on an interior edge of the through-hole in the means for longitudinally connecting, this second rotation-stopping geometry being designed to press against the first rotation-stopping geometry once the means for longitudinally connecting has been fitted on the threaded shank.

18. Device according to claim 16, characterized in that an end of the threaded shank opposite the ball comprises a male shape designed to cooperate with a complementary female shape of a tool so as to allow immobilization of the ball in terms of rotation while the tightening element is being screwed onto the threaded shank.

19. Device according to claim 16, wherein the threaded

shank has a narrowed portion delimiting two threaded regions of the shank, the narrowed portion constituting an initiator for breakage once the tightening element has been assembled and fitted on the means for longitudinally connecting, this narrowed portion therefore allowing the shank to be broken.

20. Device according to claim 16, wherein the threaded shank comprises two rotation-stopping geometries formed on a collar arranged between the ball and an opposite end of the threaded shank, and a two female rotation-stopping geometries are formed on an interior edge of the through-hole in the means for longitudinally connecting, the two rotation-stopping geometries of the through-hole being designed to press against the two rotation-stopping geometries of the threaded shank once the means for longitudinally connecting has been fitted on the threaded shank.

21. canceled

22. canceled

23. The spinal osteosynthesis device of claim 16, wherein the means for longitudinally connecting the at least two bone-anchoring elements comprises:

a shackle corresponding to each of the at least two bone-anchoring elements; and

a member that interconnects a plurality of the shackles.

24. The spinal osteosynthesis device of claim 16, wherein the means for longitudinally connecting the at least two bone-anchoring elements comprises:

a plate comprising a plurality of apertures, each of the apertures sized and shaped so as to allow engagement with a respective one of the bone-anchoring elements.

25. canceled

26. The spinal osteosyntheses device of claim 18, wherein each of the male end of the threaded shank and the complementary female end of the tool comprise a half-moon shape.

27. The spinal osteosyntheses device of claim 19, wherein the narrowed portion of the threaded shank comprises a rotation-stopping geometry.

28. The spinal osteosyntheses device of claim 27, wherein the end of the threaded shank opposite the ball comprises a male shape designed to cooperate with a complementary female shape of a tool so as to allow immobilization of the ball in terms of rotation, and wherein a cross-sectional shape of the male shape is the same as a cross-sectional shape of the narrowed

portion of the threaded shank with the rotation-stopping geometry.

29. A spinal osteosynthesis device comprising:
at least two bone-anchoring elements; and
an interconnecting element that interconnects the at
least two bone-anchoring elements;
each of the at least two bone-anchoring elements
comprising:

a head shaped so as to allow grasping with a
screwing tool;

a threaded shank pivotably connected to the head,
the threaded shank terminating in a ball positioned in
a socket on the head; and

a tightening element which can be fitted onto the
threaded shank to immobilize an assembly comprising
the interconnecting element and a corresponding one of
said at least two bone-anchoring elements,
wherein the threaded shank and the interconnecting
element are constructed and arranged so that the shank and the
ball are prevented from rotating once the threaded shank has been
introduced into a corresponding through-hole in the
interconnecting element.

30. A spinal osteosynthesis device comprising:

at least two bone-anchoring elements, each comprising a head having a shape to allow grasping with a screwing tool, a threaded shank extending from the head, the threaded shank terminating in a ball that is pivotally disposed in a socket in the head, and a tightening element that can be threaded onto the shank;

at least one longitudinal member; and

shackles structured to engage the at least one longitudinal member and the at least two bone-anchoring elements, each said shackle comprising an aperture through which the threaded shank can pass;

wherein the head of each said bone-anchoring element has a hemispherical outer surface, a spherical center of which lies as a distance from a spherical center of the socket in the head, each said shackle having a surface that conforms to the hemispherical outer surface of the head, such that when the tightening element is threaded onto the threaded shank to urge the conforming surface of the shackle against the hemispherical outer surface of the head, the threaded shackle is forced into an alignment position with respect to the head.

31. canceled

32. canceled

33. canceled

34. canceled

35. canceled